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"Advantages of the Optimized Operation of SCR Facilities"

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SUMMARY

Selective Catalytic Reduction (SCR) technology is becoming much more widespread in the electric utility industry, with many installations planned in light of newly promulgated environmental regulations. Since the industry has little direct experience with the technology, operators of early SCR facilities have focused on the basic implementation of the technology, concerned primarily with achieving the desired NOx reduction while avoiding severe operational problems. Consequently, the initial optimization and long-term optimized operation and tracking of the facilities have been of secondary concern. However, optimized operation of SCR units can result in significant life cycle cost savings, as well as the minimization of operational difficulties. This presentation attempts to demonstrate the economic and operational advantages of the optimized operation of SCR facilities. A number of parameters are addressed including ammonia injection control and distribution, inlet flue gas flow distribution, inlet NOx distribution, overall process control, sootblowing, ammonia slip tracking, and catalyst selection and testing.

Frequently the value of the initial reactor optimization is overlooked during reactor commissioning. Important parameters that should be optimized include inlet flue gas flow distributions, inlet NOx distributions, and inlet ammonia distributions. Problems such as high ammonia slip resulting in air preheater fouling associated with these parameters are not normally noticed initially since the catalyst is fresh and possesses high activity. However, as exposure time increases, ammonia slip problems become apparent. The tendency is to attribute this increase in slip solely to catalyst deactivation, but in reality the un-optimized operation of the SCR system is often the primary culprit.

Monetarily, the un-optimized operation of the system results in increased ammonia costs, increased fouling in the air preheater requiring costly air preheater washes, and catalyst replacements/additions that are performed earlier than are actually required. In addition, an optimized reactor may allow NOx removal rates to be achieved that are greater than the design value for much of the installation life, since designs must accommodate NOx reduction and slip limits at the end of catalyst life. In a NOx trading environment this results in the relaxation of NOx reduction requirements on other units, often representing a monetary savings.

Catalyst selection is an important part of SCR reactor design as are provisions for sootblowing, flow straightening grids, and catalyst screens. Catalyst design must meet the particular requirements of an installation including the sulfur dioxide oxidation that is allowable, the poisoning characteristics of the particular catalyst with respect to the fuel being burned, the physical strength of the catalyst with respect to the dust loading, and the geometric configuration of the selected catalyst with respect to the flow characteristics of the particular installation. In addition, periodic catalyst testing allows for early deactivation problems to be noted and is extremely helpful in defining whether poor system performance is due to the catalyst itself or some other operational problem. The need for flow straightening grids must be carefully addressed to avoid premature physical erosion on the initial catalyst layers and catalyst screens are often quite helpful in preventing fouling in high-dust environments.

Accurate flue gas monitoring associated with an SCR system is also vitally important to its successful operation. Since most units do not have the luxury of a continuous ammonia slip monitor, the ammonia slip must be inferred from other measurements. Most systems operate by using a combination feed-forward/feed-back control system which regulates the amount of ammonia injected based on inlet and outlet NOx measurements. Using this control scheme, it is impossible to directly infer the ammonia slip concentrations. And, in many cases the errors associated with the inlet and outlet NOx measurements can force the ammonia slip levels to be very high, without this being noticed until significant fouling has taken place in air preheaters and other downstream equipment. The long-term tracking of ammonia slip through the use of ash ammonia concentrations can be utilized to assess the performance of an SCR system and can be used to detect sudden operational upsets associated with the system as well as track the long-term deactivation of the installed catalyst.